DOCUMENT RESUME

ED 436 077 EF 005 506

AUTHOR Odell, John H.
TITLE Managing the Construction Process. School Buildings Planning, Design, and Construction Series No. 6.
INSTITUTION Association of Independent Schools of New South Wales, Ltd., Sydney (Australia).
ISBN ISBN-0-646-23758-6
PUB DATE 1995-00-00
NOTE 27p.; For other booklets in this series, see EF 005 501-508.
AVAILABLE FROM Association of Independent Schools, NSW Ltd., 75 King Street, Sydney 2000, Australia (Available from source only as a complete set, #1-8). Tel: 02-299-2845; Fax: 02-290-2274.
PUB TYPE Guides - Non-Classroom (055) -- Reports - Descriptive (141)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Construction Management; Construction (Process); *Educational Facilities Design; *Educational Facilities Planning; Elementary Secondary Education; *Facility Guidelines; Foreign Countries; *School Construction
IDENTIFIERS *Australia

ABSTRACT

A school construction guide offers key personnel in school development projects information on the complex task of master planning and construction of schools in Australia. This chapter of the guide provides advice in the area of managing the construction process, covering such topics as consultant appointment and management, various contracting methods, forms of contract, time management, budget control, managing contractual changes, and post-contract management. Specific topics include an explanation of consultant types, agreements, and fees; securing quotes for work; assessing tenders; and describing the roles of the project and construction managers. (GR)

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School Buildings

Planning, Design and Construction

John H Odell FRAIA ASIFC
in association with the
Association of Independent Schools of NSW Ltd

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MANAGING THE CONSTRUCTION PROCESS 6

Ray Whitfield

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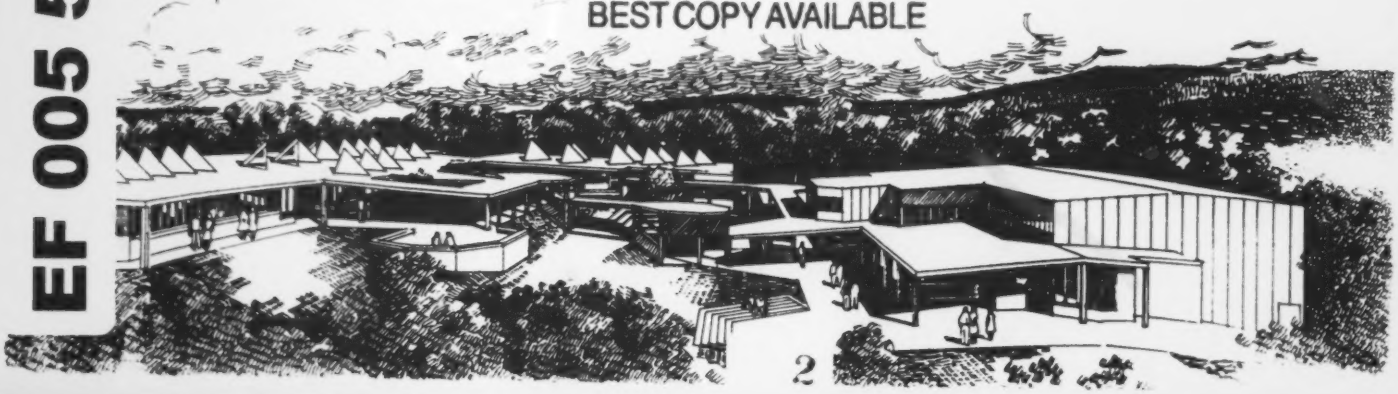

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School Buildings, Planning Design and Construction is presented in a ring binder with 8 booklets. The document is available only as a complete set

1	Introduction and Chapter 1 – Developing a Master Plan
2	Chapter 2 – Making the Most of Your School Site
3	Chapter 3 – Principles of Good School Building Design
4	Chapter 4 – Purpose Designed Facilities
5	Chapter 5 – Construction Methods and Materials
6	Chapter 6 – Managing the Construction Process
7	Chapters 7 and 8 – Technology and Managing Buildings
8	Appendices

ISBN 0 646 23758 6 refers to the complete set of 8 booklets

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Epping NSW, Australia

First printed 1995

Published by
The Association of Independent Schools, NSW Ltd
75 King Street, Sydney 2000, Australia
Phone (02) 299 2845 Facsimile (02) 290 2274

School Buildings - Planning, Design and Construction

A Guide Document

for School Councils, Boards and Committees, School Principals and Staff and Construction Professionals

Author - John H Odell FRAIA ASTC

Introduction to

School Buildings – Planning, Design and Construction

Good school buildings do not just happen. Thought and consideration must be given to the needs of the users of the building and to the available resources. The persons responsible for building the school should have considerable experience or draw on the advice of those who have.

For a building to be satisfying and successful it must provide shelter, have durable construction and finishes, be aesthetically pleasing and appropriate to its use. A well-planned school will incorporate the following points:

- buildings and grounds will satisfy and support both short and long-term requirements
- curriculum demands including requirements for registration by authorities will be met
- site development will not be haphazard and each project will pave the way for the next
- building design will be flexible to cater for as yet unknown future requirements
- building will be cost effective - and in the long term the school will avoid unnecessary expensive recovery action
- good building design will encourage a high quality educational environment
- pre-planning of maintenance requirements will assist in reducing operating costs

This guide is designed to assist key personnel in school development projects with the complex task of master planning and construction of schools.

Individual chapters in this guide may be distributed to relevant key personnel as appropriate to their specific interest and responsibility.

Each chapter is a separate booklet with chapters 7 and 8 bound together in one booklet and chapter 9 in booklet 8.

The chapters:

1 Developing a Master Plan for Your School
2 Making the Most of Your School Site
3 Principles of Good School Building Design
4 Purpose Designed Facilities
5 Construction Methods and Materials
6 Managing the Construction Process
7 Technology and Educational Buildings
8 Managing School Buildings
9 Appendices

This Guide aims to:

- demonstrate the necessity for school communities to produce comprehensive master plans for the development of their school
- encourage school staff and boards to be involved in the development of school facilities and to draw on the wider experience of the community during that process
- outline planning processes and techniques that will lead to greater creativity in school design with greater efficiencies and productivity in the construction process
- help school staff and board members in their dealings with professionals in the building industry, and vice versa
- encourage excellence in school facilities
- maximise potential of limited resources to achieve desirable outcomes
- provide advice on how to determine whether a particular facility is vital to a school
- provide examples of excellence in school building and planning
- provide a comprehensive list of contacts, resources and references.

Who should read this Guide:

- All school council/board members
- Principals, bursars and other key staff members
- All members of school building and planning committees
- Administrators in control of school building projects
- Construction industry professionals, especially school architects

Contents of Booklet 6

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Managing the Construction Process

6. School Facilities - Managing the Construction Process

This chapter covers the issues pertaining to:

- the appointment and management of professional consultants (6.1)
- tendering - the various ways of contracting (6.2)
- forms of contract (6.3)
- project and construction management (6.4)
- time management (6.5)
- budget control (6.6)
- managing change to the contract (6.7)
- post-contract management (6.8)

It would be unusual to find within any school organisation, people with sufficient skills and time to properly design, manage the construction process and bring a building project to fruition.

Staff enthusiasm to engage in a new activity should not be allowed to interfere with their commitment to their regular workload. Volunteers are not likely to have the time, over the long haul, to complete even a fairly simple project. Any difficulties which might emerge are likely to jeopardise and sour long-standing relationships. It is often more constructive to use such willingness and availability in a consultative way.

....managing the construction process, appointing professional consultants, budget control....

The Planning Team will need the support of professional construction teams which bring together all the skills necessary to construct the physical environment of the school: the underground services, the foundations, the playing fields or the buildings.

The various forms of contracts are covered, as well as the concept of project or construction management. And finally, post contract

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management is covered -- what happens after the builder has left and problems arise, how do things get fixed?

6.1. Consultants - appointment and management of consultant teams

The professional consultants related to the construction process include architects, quantity surveyors, electrical and mechanical engineers, structural and civil engineers and hydraulics engineers. In certain cases traffic, acoustic and landscape consultants may also need to be employed.

In sections 6.1.1- 6.1.3, a more detailed list of the various kinds of consultants and their role is given. (See also Appendix 9.15)

Professional builders and project managers also can provide valuable advice to planning teams.

The expert advice provided by construction consultants is often available in the early stages on an honorary basis, particularly to schools in their infancy from firms keen to establish a professional and long term relationship.

Advice given in this way should be treated with respect as professionals are not able to relieve themselves of professional responsibility by the honorary status. In any case, a consultant is unlikely to be able to provide such advice for a sustained period without compromising his or her practice financially. For this reason fees should be agreed on at an early stage as a basis for an ongoing relationship.

The consultant is expected to provide certain professional services in return for adequate remuneration commensurate with the value of the advice given and also with the professional liability the consultant incurs in giving such advice.

Keep in mind that the primary role of the various consultants is to provide advice, not make decisions. Consultants will of course make decisions within the confines of their discipline. They will also make decisions when specific delegation is given.

School councils and their representatives must understand their leadership role in the decision making process. School councils should avoid either allowing or forcing their consultants into that role by default. When this happens the benefit of expert consultant's advice is often minimised as not all facts are available to the consultant in every instance and decisions may be made using a different set of priorities.

6.1.1. Head Consultant

The head consultant is usually an architect who manages the other specialists.

In some projects, a project manager is appointed to this role. In this event, the architect will often continue to coordinate the work of specialist consultants (e.g. engineers) with regard to the building and site. The project manager might manage the costing

professionals (quantity surveyors, traffic engineers), consult with authorities and manage the general day to day building program.

The head consultant oversees and manages the total consultative process. The construction process would be managed by a builder or construction manager (whose job may be separate from that of the project manager).

Architect

Once the decision is taken to construct a building or even prepare a Master Plan the appointment of the architect is one of the most important decisions in the process .

The two major tasks of the architects are:

- to conceptualise the facility in such a way that it will best serve the educational program
- to lead the design team in designing and constructing the facilities.

The architect should be able to:

- demonstrate the ability to design according to the client's brief
- produce designs within budget
- produce creative solutions to problems presented by difficult sites, constraints of council requirements, neighbours objections
- maintain time schedules

Methods for appointment of architects

There are a number of ways a school council can go about the appointment of an architect or architectural firm.

Design Competition

This method involves selecting a number of architects and inviting them to submit proposed solutions to a particular task (e.g. an Outline Master Plan) based on a draft set of criteria.

The school should pay a fee to each competing architect with the successful architect being appointed to the project. This option is more attractive and fair as there can be considerable costs involved in preparing even a notional Master Plan. Built into such an arrangement should be the potential for using ideas presented by any of the architects in the final scheme. In this way the additional expenditure can be more easily justified.

If no remuneration is offered (apart from the potential of securing a commission) the more experienced firms may not compete - thus the school may not secure the best professionals available.

If a design competition is to be held, a school representative should approach the relevant chapter of the Royal Australian Institute of Architects for advice, assistance and guidelines for such competitions, otherwise there may be some limitation on Institute members being involved.

Direct Appointment

This is the usual method of appointment and occurs where a firm of architects is known or recommended because of their expertise and experience.

A possible down-side of this method is the tendency to use old and tired solutions to new problems - younger and more enthusiastic and possibly more creative professionals are less likely to secure commissions in this process. Firms of architects overcome this by bringing in to their firms new experience and appointing them to operate alongside experienced architects.

Comparative Selection

This is probably the most useful and reliable method of appointing an architect. It involves establishing a range of criteria on which firms are evaluated, and inviting firms to present submissions responding to those criteria.

By this means, the various skills can be assessed and the most appropriate firm selected.

The criteria usually includes:

- demonstrated design skill
- ability to perform to program
- capacity to design within budget
- capacity to lead a team of professionals
- capacity to work with client (in this case the school)
- current work load in relation to available staff
- "after sales" service -follow up of problems once the building is occupied

As supporting evidence for the statements, architects should be requested to provide references from present and former clients. A form prepared using the above criteria would assist the referee to comment.

Project Manager and Construction Management

For a description of the roles of project manager and construction manager refer to section 6.4.

6.1.2. Appointment of consultant team

The team of consultants may be employed either directly by the school or through the head consultant. In either case, coordination of the team should be included in the responsibilities of the head consultant.

Some consultants may prefer to give their advice to and be paid directly by their client. This may undermine the head consultant's leadership of the team. In these cases, the school must make clear to the consultants that while payment may be direct from the school, the school will rely on the advice of the head consultant.

A method sometimes employed is to have the head consultant put together a complete package where the responsibility for the appointment, receipt of advice from consultants, and payment all

are channelled through the head consultant. In this arrangement there can be no dispute as to who is responsible for the performance of the consultant team.

6.1.3. Types of Consultants

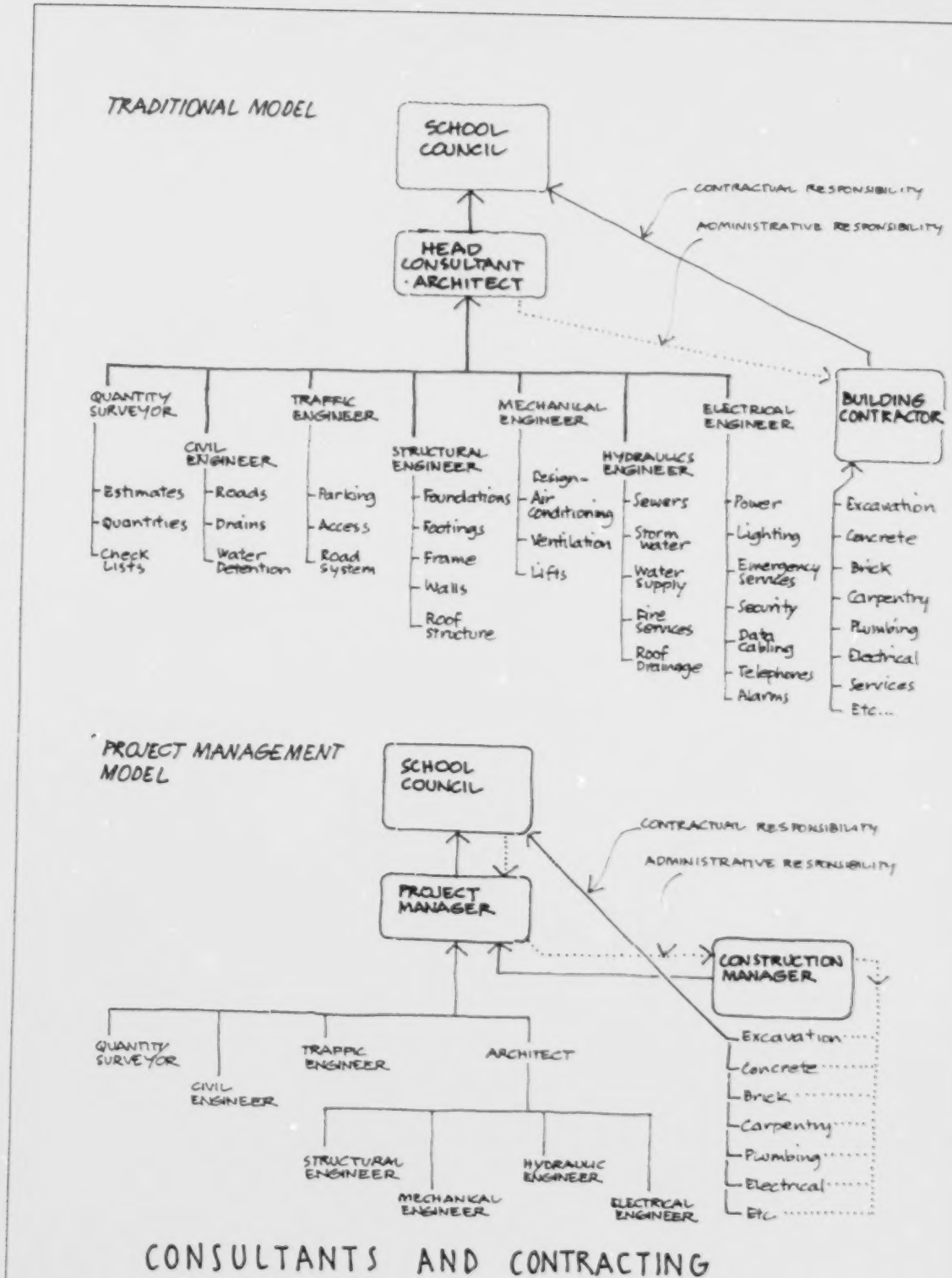
The various consultants that may be employed in a school building project include:

- **architect** - design and construction as well as overall coordination of the project
- **quantity surveyor** or cost consultant - construction costs and cash flow; costs of variations to project; monitoring of the total budget.
- **structural engineer** - structure of the buildings; foundations, framing (steel or concrete); floors and roof construction (particularly where large spans are involved).
- **civil engineer** - roads; major drainage; water retention basins
- **hydraulics engineer** - sewer; stormwater design and construction; water and gas supply; fire services; hose reels and hydrants
- **electrical engineer** - light and power reticulation and equipment including exit signs and safety equipment; special power systems such as uninterrupted power supply (UPS); protected power supply for computer systems; low voltage for technology rooms and DC supply.
- **traffic engineer** - assessment of traffic related to school and to surrounding community (often required as Development Approval stage)
- **acoustics consultant** - environmental assessment; sound engineering in multi purpose halls and music facilities
- **mechanical engineer** - design and construction of ventilation and air-conditioning systems, extraction equipment in technology workshops, food service areas and toilets, lifts and hoists.
- **interior designers** (professionally qualified consultant) - furniture and furnishings; colour; carpet and space planning.
- **library consultants** - methods for storage of books; planning for security of stock; lighting and layout; supervision and access.
- **sports field design consultants**.

6.1.4. Consultant Agreements

The various professional bodies or associations of professional construction consultants have standard agreement forms which cover matters such as responsibilities, liabilities, duty of care, handling of information and communication and the like as well as a basis for fees – often a choice depending on the circumstances.

The school should seek formal submission either to the head consultant or to the school depending on the arrangements to be entered into as to the nature of the contractual arrangement to be entered into by the consultant. Any delay has the potential of dispute which increases as the delay continues.



CONSULTANTS AND CONTRACTING

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6.1.5. Fees

The tasks of the consultancy team usually cover the following areas:

- schematic design (involves very preliminary sketches and costings illustrating general direction of design intention)
- design development – on completion of this phase the design team should be able to commence contract drawings, the design process will be largely complete.
- Contract Documentation – the completion of this phase permits tenders to be called
- Tendering Phase (involves obtaining tenders up to the signing of a contract, and includes the negotiations)
- Construction Phase – the completion of this phase will be the handing over the facility for occupation.

As one example the percentage of the total fee paid on completion of each phase is as follow:

- Schematic Design 15%
- Design Development 15%
- Contract Documents 40%
- Tendering and Construction 30%

For example if the total fees amount to 12% of the cost of the project, say $1.5m, at the end of the Schematic Design stage the school will be liable for $27,000.00 in consultants fees.

The fees are usually quoted as a percentage of the total cost and the percentage can vary significantly depending on the current state of the market and on the size of the project. Unless a fixed fee is quoted the final fee will be calculated on the final cost. Allow for this in budgeting.

It is not always wise to choose the lowest fee. Each consultant should be chosen for the demonstrated capacity to carry out the design and documentation process in a competent and efficient manner. A consultant who has some empathy with the school's philosophy and/or the school board and their objectives can be an advantage. Do not, however, rely on this and avoid spending adequate time in briefing the consultant.

For estimating purposes in the initial phases of costing, the overall professional fees for full services, that is from commencement through to completion of the project should be in the order of 12% to 15% of the cost of the project. A word of warning – fees can vary significantly depending on the sizes of consulting firms, the size of the project, the level of service required or offered, the current state of the construction industry and the level of competition and could be in certain instances somewhat lower than that stated below.

As a general guide the fees can be broken down as follows:

- Architects 6%
- Structural Engineer 1.5%
- Mechanical Engineer 1.5%
- Electrical Engineer 1.5%

- Hydraulics Engineer 1.5%

These percentages are of the total cost of the building and should be used only for very preliminary estimating. The actual fees are calculated using a percentage based on the actual cost of the relevant work involved.

For example the cost of the hydraulics consultants work may represent 1% of the total cost of $1m project. His fee may be 6% of the cost of the hydraulics work.

If this basis is used to determine the fee, then the various trades should be listed separately in the tender submission so that the appropriate fee can be calculated.

6.1.6. Design reviews

The brief to the consultant as to how the work is to be carried out should include regular review meetings of the design as it is developed.

This should be part of the consultants own requirements in order to maintain clarity in regard to his instructions. A school should be sure to encourage consultants to call regular meetings for reviews of the design process.

6.1.7. Preparation of Brief to consultants

Details of the kind of information that might be contained in a consultants brief is a response to the information provided in chapters 2,3,4,5 and 6.

The consultant's brief is a document prepared by the school to describe what is to be provided in the finished project. It usually covers cost limits and time constraints. The brief is also the instrument by which the performance of the consultant is measured.

It is useful to have at least the head consultant involved in the preparation of the brief to help identify and clarify issues and to eliminate impractical requirements at an early stage.

The consultants should not be allowed to dominate the preparation of the brief as they may hinder a full expression of requirements which could lead to an inadequate response to the real needs of the school.

6.2. Tendering - the various ways of contracting

Tendering is the process of securing quotations for work based on a set of documents which will form part of a contract with the successful tenderer.

The following principles should be observed by schools in order to be fair to all parties and to ensure sound contractual arrangements.

- school authorities should have due regard to the cost of tendering

- collusion, hidden commissions and secret arrangements should be prohibited
- all tenderers should receive the same information
- if a question is responded to, then all tenderers should receive a copy of the question and the response
- adequate time should be allow for a proper response to the invitation to tender - usually 3 weeks or longer
- all tenders should remain sealed until specified opening time for all
- confidentiality of tenders must be assured
- while it is not necessary for tenders to be opened in public in most cases, sufficient witnesses should be present, representing both the school and the consultants
- proper records of the opening should be made, listing names and prices submitted as well as any conditions
- any parties with a conflict of interest should declare themselves (e.g. members of school boards wishing to tender for projects should resign from the board and/or distance themselves from the selection process completely).

Australian Standards Association sets out guidelines for tendering in AS4120-1994 Code of Tendering.

Should negotiation of conditions be required with any of the tenderers, it is usual for the lowest tenderer to be given the opportunity first to resolve them. If negotiations lead to the price being lifted above that of the next tenderer and that tender is unconditional then it becomes the lowest tender.

If the next tender is also a conditional tender the process must be repeated.

This process can take a considerable amount of time. For this reason you may, with consent of the tenderers, have concurrent negotiations, taking care to preserve the confidentiality of each bid. It is important to refrain from "playing off" one tenderer against the other.

When a building is constructed by the traditional method - that is by inviting tenders and selecting the best (usually the lowest) it will be obvious that the builder can not commence until tendering negotiations are complete.

One of the weaknesses of the traditional tendering method is that the expertise of the chosen builder is not brought to bear on the design until most of the decisions have been made. If the builder makes suggestions regarding construction methods it is difficult for the school to know whether the recommendation is coming forward to save its resources or those of the builder. It is not a serious enough weakness, however, to set aside the traditional tendering process.

6.2.1. Tender Registrations

There are various ways of determining who should be eligible to submit a tender. Tendering can be open - that is anyone who asks for tender documents can receive a copy and submit a tender. An

alternative is closed tendering where the tenderers are invited. In this case the lowest conforming tender should be accepted.

An alternative to both the above is to call for registration of name of tenderers along with sufficient details to permit checking of their capacity to do the work and their acceptability in general. The advantage of this method is that the checking (which would be required after tenders closed in open tendering) can be done beforehand. In this form of tenderer selection, the lowest conforming tender should also be accepted.

School authorities should be aware that the preparation of a tender involves a substantial amount of work. Tenderers need assurance that this work serves some useful purpose and that if the effort is made to submit a tender it will be reviewed fairly and not be rejected on a capricious basis.

ICAC (Independent Commission Against Corruption) has prepared a booklet entitled "Pitfalls or Probity - Tendering & Purchasing Case Studies". This incorporates a number of case studies illustrating various aspects of tendering including patterns to avoid. One of these entitled "How Not to Assess Tenders" is incorporated here with permission. This appears on the next page.

11

How not to assess tenders

A college used a tender process annually to select a "preferred supplier" of personal computers. The successful tenderer got most of the college's computer business for the next year. One supplier had won the tender twice, and its second contract had been extended for a further year. During the three years, the supplier had obtained close to $4 million worth of business through the college.

The college's PC Committee met to develop specifications for the third tender. The Committee discussed the ideal PC requirements, agreed on technical specifications and proceeded to advertise. Almost 50 tenders were received.

Shortly after tenders closed, the Committee met to decide how to assess the tenders. Considerable time was spent discussing important criteria such as quality of equipment, supplier reliability, servicing, responsiveness to the college's needs, and value for money. However, committee members could not agree how to assess these factors or what priority to give each. Some members felt the location of suppliers (local or city-based) would affect servicing and reliability. The tenderers had not been asked for information on any of these criteria. They had only been required to meet technical specifications and quote a price per PC.

Committee members held such differing views that they decided a formal assessment was impractical. To decide on the winning tender, they first eliminated the 25 highest priced tenders (adjusted by the committee to account for differences in hard disk and memory capacity). At a subsequent meeting, the field was reduced again, but the basis for culling was not recorded. Some further information was obtained from some of the short-listed suppliers but it was also not recorded. One of the committee members felt uncomfortable about the lack of documentation and independently prepared a spreadsheet comparing various factors.

Finally the committee members "voted". Each secretly wrote down the name of any of the remaining tenders he or she thought suitable. The current supplier was the only one to appear on all members' lists and on that basis was awarded a further two-year contract with a one-year option.

6.2.2. Department of Employment, Education and Training (DEET) Requirements - Tendering Process

Schools securing a capital grant from the Commonwealth should be aware of their tendering requirements:

- oversight by building industry professionals
- adherence to Australian Standard (AS4120 – 1994) Australian Standard Code of Tendering
- comprehensive documentation as basis for tender
- project completion time stated in tender
- competition to the greatest extent possible for all major elements
- claims for payments to be certified by a competent building professional

Schools participating in a capital grants program will be supplied with the necessary documentation and should ensure guidelines and requirements are adhered to.

6.3. Forms of Contract

This section covers the following three forms of contract and their respective types of remuneration, in view of various controls – most importantly cost control – that the school will want to maintain:

- lump sum (6.3.1)
- rise and fall (6.3.2)
- fixed fee (6.3.3)

6.3.1. Lump Sum

A lump sum contract is simply an arrangement whereby a builder offers to do a specified amount of work for a fixed sum of money. If there are no changes to the amount of work there will be no changes to the contract sum payable by the school. This is rarely the case, however, as most contracts have to be changed for various reasons such as:

- changes in conditions below the ground - foundation changes
- changes to requirements that emerge during the construction phase
- items overlooked in the preparation of the contract documents
- changes in contracts involving renovation work

It is possible to ensure reasonable prices in such circumstances by requiring the tenderers to submit rates for the work where changes might be anticipated such as:

- excavation in soil
- excavation in rock
- the various finishes and structural elements (the consultants will provide a list)

Variations are notorious for causing disputes between a builder and the proprietor. During the tendering process each builder will submit the lowest possible price. If the contract documents are not clear or the cost has been underestimated there may be a tendency for some builders to pursue variations, some vigorously - hence the potential for dispute.

6.3.2. Rise and Fall

Rise and fall contracts involve tenderers' submissions based on current prices with an agreed and recognised formula for calculating the variation in the cost of the project based on certain indices. This method is recommended during times of high inflation.

A number of formulae (with which professional consultants will be familiar) may be applied. As they are usually very technical and detailed, they will not be described in this document. Often, Quantity Surveyors are required to complete these fairly complex calculations.

In times of low inflation, the lump sum form of contract is preferred. However, when inflation and building activity are running high, tenders for lump sum contracts will include an estimate of inflation to compensate the builder for increases in cost. This estimate is likely to be higher than actual cost increases. Therefore, when costs are increasing rapidly, a rise and fall formula is preferred because it provides a precise method of determining the increase in cost to which the contractor is entitled.

6.3.3. Fixed Fee Contracts

Where the cost of a project is indeterminate, fixed fee contracting provides for reasonable controls on costs. The fixed fee is the amount paid to the project manager for the work of completing the project. The fee remains the same irrespective of the cost.

Fixed fee contracts allow for incentives for the project manager to minimise cost, to complete the project on, or ahead of, schedule and within budget. Provided there is a good basis for trust and a good performance reputation, this is a reasonable basis to carry out a project.

A list of typical contractual documents is provided in Appendix 9.14.

6.4. Project and Construction Management

A project manager or project management company is often responsible for the total design and construction process: from the giving of the brief (may even be involved in the preparation of the brief) to the handing over of the building to school, after the completion of the defects liability period. Thus, the project manager is usually appointed very early in the process.

The main advantage of using a project management approach, rather than an architect and builder, is that the school can ask for a one-off total fixed-price contract not subject to variables, for the whole project.

The project manager may continue an involvement past completion into the management of the facility, although this is unusual in schools where facility management is undertaken by those associated more intimately with the school.

The project manager should have a wide knowledge of the building industry, experience in handling the wide variety of trades, as well as the various authorities such as the local council, water and drainage authorities.

The project manager should also be skilled in managing a team of professional consultants and be able gain their respect and cooperation.

Construction Manager

A construction manager takes the place of a builder and, therefore, is associated only with the actual construction process. Once the contract documents are signed, the construction manager oversees the appointment of contractors and coordinates their work.

The construction manager may commence work once the contract is in effect, to ensure that documents for the calling of the various contracts are prepared in the most advantageous way.

The project, if large, often warrants the employment of a project and/or a construction manager. In some cases these are the one and the same. The project manager is engaged to oversee the whole project for the client including the engaging of and managing the team of professional consultants. The role of the construction manager is to manage the construction phase of the work.

If the project is relatively small a school council may elect to undertake the role of project manager - usually by delegating the responsibility to a building subcommittee but this is recommended only where the committee has adequate expertise and knowledge of the construction industry.

Alternatively a builder may be engaged to be the construction manager.

While cost savings can be an aim of adopting a construction management model, i.e. to eliminate the builder's profit margin on subcontracts and reduce the cost of supervision this can only be achieved if the person replacing the builder can carry the responsibility and perform adequately for less cost.

This model should only be undertaken with due care, as often the anticipated savings can be offset by poor decisions made due to lack of experience. Volunteer or inexpert consultants should not be expected to sustain adequate input over the period of a building contract. Problems to guard against which could offset possible savings include:

- poor programming - trades not being available at the right time creating costly delays
- poor coordination of the contracts and work being omitted from two sequential contracts e.g. the blinding layer over-fill under a concrete slab on ground
- core holes not being left for services
- electrical conduits not being laid in time for concrete pour

Some BGA's have established guidelines for those intending to seek approval from the Commonwealth in projects with Government Grants in the use of Project Management. The Association of Independent Schools NSW Capital Grants Committee has prepared one such guideline document. A summary will be found in Appendix 9.12

6.5. Time Management

Managing time involves:

- establishing an overall program, including all major events such as approval of brief, local authorities approvals and letting of contract
- modifying the program as necessary to accommodate unforeseen developments
- making proposals to adjust for lost time
- gaining the cooperation of various agents and consultants in maintaining momentum
- preparing and circulating modified programs to all involved

There are a number of computer programs which facilitate the preparation of schedules. It would be appropriate to insist that the chosen managers have experience in the use of these, alternatively can demonstrate a capacity to maintain such a program over the course of a project.

6.6. Budget Control

Budget control commences at the inception of the project and continues with increasing refinement to the end. It requires having sufficient information and tools to make informed decisions.

Budget control does not necessarily require acceptance of the lowest cost – spending more money in the early stages of the project may save money at a later time.

Total expenditure can be monitored continually against estimates. Decision makers are then in a position to implement cuts (where the budgeted cost estimates have been exceeded) or to allow additional expenditure (where savings make it possible).

Computer technology and appropriate expertise make budget control an easily manageable task. However, adequate funding

should be allowed in budgets for professionals to undertake this work.

A computer spreadsheet which lists the various facets and trades sections of the project and the variables enabling regular review of anticipated final cost is necessary for effective budget control.

To emphasise the importance of careful management the following excerpts from "Size, Cost and Creativity within Commonwealth Guidelines" has been reproduced with permission. It is from an address to the National Seminar of BGA Officers, November 1981 by Geof Nairn and Tom Heinrich. The address covers a wide range of issues and would be valuable information for the Master Planning Team.

A copy is available from the author.[1]

- *"Schools of the future have to operate more like a business enterprise in the sense that their growth, upgrading, operating costs and "return" have to be "professionally" managed."*
- *"...the cost of a proper development strategy is most likely to be covered by the savings it produces in the very first stage."*
- *"The longest lasting buildings, with the least need for ongoing costs for maintenance and replacement, attract higher initial cost."*
- *"...to approach guideline cost (Commonwealth Guideline costs) decisions regarding choice of materials are often made that are not in the building owner's best interests....domestic aluminium windows with far higher maintenance costs.....cheaper floor finishes which wear out much faster...."*

6.7. Managing Change to the Contract

Changes are inevitable – some common reasons include:

- change in requirements of client
- requirements of authorities
- costs over-runs
- unexpected events and circumstances, such as prolonged inclement weather, unexpected underground conditions or services
- unavailability of materials

Some of these possible changes may be factored into contracts so that the school is not liable. In so doing the school is in effect paying up-front for the risk the contractor is taking.

The budget should include a contingency sum to cover variations. An appropriate contingency would be approximately 2.5% of the total estimated contract value. Contingency sums need to be managed and should be spent only as explanations are provided.

6.8. Post-contract management

6.8.1. Conclusion of contracts

A building contract is concluded by a series of events which may include:

- Occupation - full or partial, which often coincides with the commencement of the defects liability period
- End of the defects liability period
- End of contractual arrangements for management of service systems included as part of the construction contract
- End of guarantee period for items of equipment required by the construction contract.

The head consultant is usually responsible for administering the contractual obligations of the school and that of the contractor (the parties to the contract). Responsibilities include:

- giving notices at appropriate times
- authorising payments
- listing defects to be corrected
- certifying payments
- giving notices for completing the work, and for correcting the defective work
- providing the required information, such as maintenance requirements.

6.8.2. Records of services

Services layouts

At the very earliest stage of the project the school should advise the Head Consultant to require all contractors, including the main building contractor, to provide "as constructed" drawings and details. These are usually based on the contract documents and include all changes that have been made for whatever reason, for example, client change, changes due to authorities, changes due to unforseen circumstances (underground water courses affecting foundations).

All services, particularly underground services should be clearly identified both as to type of service, direction of flow, depth below datum (an assumed level related to some permanent feature, not

ground level as this can change over time) and horizontal distance from permanent features.

This information, with computer aided drafting (CAD) technology can be easily updated from contract documents. This information should be obtained as early as possible, even before trenches are backfilled and while those with the information are on site.

Progress photographs are a valuable asset in this regard. Photographs with dates are useful in dealing with disputes that arise.

6.8.3. Post Contract Maintenance

Maintenance manuals

With mechanical services such as air conditioning, comprehensive maintenance manuals should be provided including: drawings illustrating all the equipment and locating all parts requiring regular inspection and maintenance as well as a recommended program for maintenance.

Maintenance Agreements

A one-year free maintenance agreement is commonly included in the tender price. This is sometimes done to attract a long term contract.

At the end of this period, the school should call for tenders based on the recommended maintenance program (after checking with the consultant as to its adequacy) and offer the long term maintenance contract to the lowest reputable tenderer.

Log books of services

For each item of equipment, a log book of service provided should be kept, including the following:

- date of service
- a brief description of the work carried out
- kind of service, whether routine or emergency repair
- person carrying out the work
- time and date of arrival
- time and date of departure
- signatory of appropriate school representative (for authorising accounts payable)

The consultant and or contractor sometimes establishes the format of these log-books.

Not all the above information is in the interest of the contractor, but nevertheless is important to the school and, therefore, should be kept up to date.

Maintenance program

Three main areas of maintenance are:

1 Buildings

2 Grounds

3 Equipment

Buildings

A long-term maintenance program should be developed by every school; it will incorporate regular repainting, inspection of roofs, inspections of sealants in external junctions exposed to weather, etc. (See check list - Appendix 9.15)

Procedures and information relating to emergency repairs - initially, try to use contractors who carried out the work, provided that a good relationship exists and that their work was satisfactory. Include personnel, phone and fax numbers, account details. It may be appropriate to establish rates for certain types of work, for example hourly rates for attendance based on tenders for maintenance work.

Grounds

Programs for:

- regular cutting of grass lawns
- replanting of gardens
- planting of trees
- fertilisation program
- weed control (avoid during and just before term time as some residual problems apply to some forms of control)
- checking of drainage systems, removal of debris from drain sumps
- fences
- hard court surfaces
- roads, ensure cracks in pavement are sealed promptly
- pathways

Equipment

Programs for maintenance of:

- air-conditioning installation including cooling towers, particularly if water type
- sewerage pumping facilities
- emergency lights and batteries
- vehicles
- stoves, lathes and other large equipment items in TAS areas in particular

While not part of the building process, it is worth mentioning that schools commonly upgrade or expand their equipment stock. A school will be well served if a program is put in place to ensure that future maintenance is appropriately scheduled and provided for equipment such as photocopiers, faxes and educational equipment

6.8.4. Asset Management

For comprehensive help in asset management, schools will find much help in the Total Asset Management Manual published by the New South Wales, Public Works Department, Policy Division.

The manual contains articles on Economic Appraisal, Value Management, Post Completion Reviews, Capitalisation Guidelines, Risk Management, Life Cycle Costing, Asset Register Guidelines and Energy Management.

There is a companion manual equally informative referred to as the Capital Project Procurement Manual. This manual deals with Codes of Practice, Tendering in relation to construction projects, Various aspects of the culture relating to the construction industry such as quality assurance, Relationship management such as Contracting, Planning in particular relating to the construction program and Management of the construction consultants.

These Manuals can be obtained through the NSW Public Works Department, Asset Management Policy Unit, McKell Building, Rawson Place, Sydney. Phone (02) 372 8877.